



Low Wind Speed Technologies Program Subcontract Overview

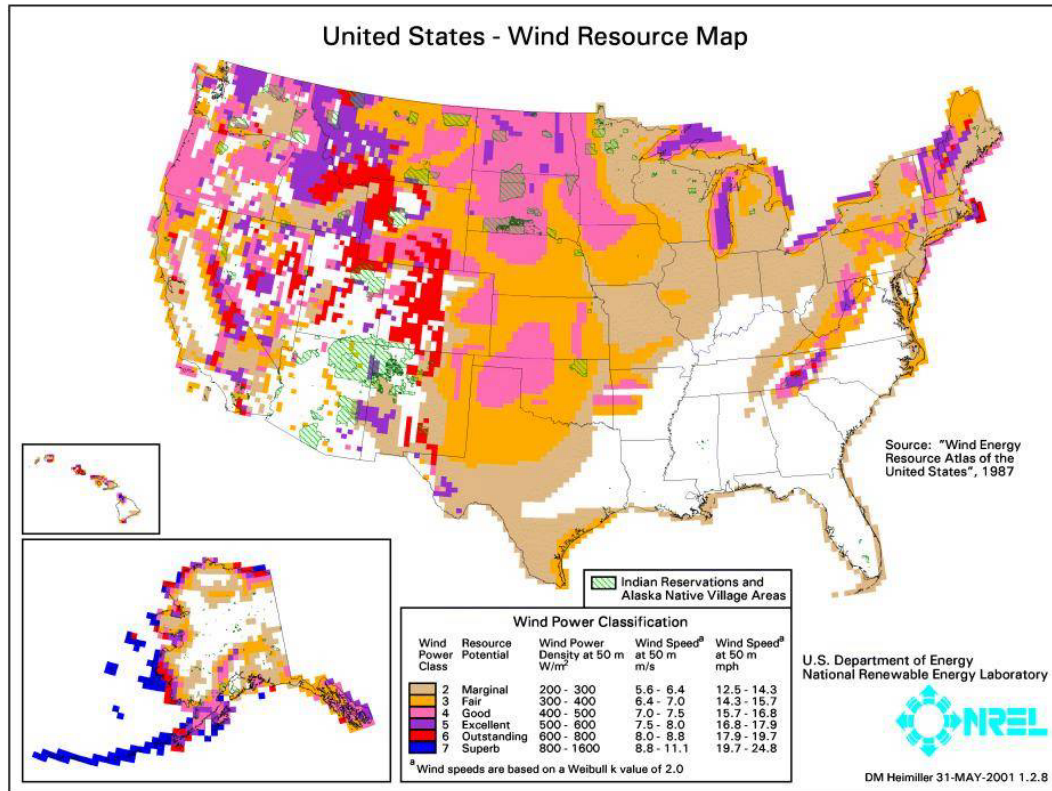
**FY2005 DOE Wind Program
Implementation Meeting
November 17, 2004**

**S. Schreck and A. Laxson
NREL's National Wind Technology Center
Golden, CO**





Goal and Impact



- **Goal**

- Utility class, landbased
- 3 ¢/kW · hr in Class 4
- 2012 target date

- **Impact**

- Shorten average distance to load center x 5
- Expand developable land area x 20

- **Authority**

- Directed by Administration
- Monitored by OMB through DOE
- Managed via COE performance (ATTU)





Program Structure



- **Technical areas**
 - Concept Design Studies (\$200K, 6 months)
 - Component Development (\$2M, 2-3 years)
 - Prototype Development (\$8M, 2-4 years)
- **Time phasing**
 - Phase I RFP, October 2001
 - Phase II RFP, June 2003
 - Phase III RFP, 2007 (projected)





Guiding Principles



- **Public/private partnerships**
 - Industry initiatives
 - Intramural research and testing
- **Flexible and adaptive**
 - Multiple pathways
 - Repeated opportunities
- **Performance based**
 - Annual Turbine Technology Update
 - Periodic review





WindPACT Drivetrain/PE



- **Global Energy Concepts**
 - Study report published August 03
 - <http://www.nrel.gov/docs/fy03osti/33196.pdf>
 - Generator/PE fabrication complete
 - Awaiting dynamometer availability
- **Northern Power Systems**
 - Study report published May 04
 - <http://www.nrel.gov/docs/fy04osti/35524.pdf>
 - Generator/PE fabrication nearly complete
 - Awaiting dynamometer availability





WindPACT Blades



- **Global Energy Concepts**
 - Blade system design studies (30 m – 70 m)
 - Material focus – coupon testing
 - Advanced materials and different processes
 - Tension/compression, static/fatigue
- **TPI**
 - Blade system design studies (30 m – 70 m)
 - Structural focus – thick truncated geometry
 - Test thick truncated airfoils in wind tunnel
 - Design, fabricate, test 9 m subscale blade





Phase I Concept Studies



- **Berger-ABAM**
 - Hybrid concrete-steel tower
 - Final report published
- **Advanced Energy Systems**
 - Advanced independent pitch control
 - Final report in preparation





Phase I Components



- **Northern Power Systems**
 - Advanced PE for LWST applications
 - Preliminary Design Study complete
 - Final configuration selected
 - Detailed Design Review 11/30/04





Phase I Prototypes



- **Clipper Quantum Turbine**
 - DGD-1 testing completed July 04
 - DGEN-Q being installed in dynamometer
 - Targeted completion 1/1/2005
 - Test site selected (Medicine Bow)
- **General Electric Multi-Megawatt Turbine**
 - Parametric studies review December 04
 - Subscale component validation
 - Detailed design
 - Full-scale fabrication
 - Field testing





Phase II Concept Studies (Landbased, Initiated)



- **Behnke, Erdman, Whitaker**
 - Investigation of the Application of Medium Voltage Variable Speed Drive Technology to Improve the COE from Low Wind Speed Turbines
- **Peregrine Power**
 - Breakthrough In Power Electronics From SiC
- **New Generation Motors**
 - Conceptual Study of Multi-Unit Common Shaft, Variable Air-Gap, Axial Flux Permanent Magnet Generator for Use in Low Wind Speed Turbines
- **General Electric**
 - Integrated Wind Energy/Desalination System



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Phase II Concept Studies (Landbased, Initiated)



- **Native American Technologies**
 - Automated Thermal Plate Forming of High Stiffness, Self Erecting Towers for Low Wind Speed Turbines
- **Global Energy Concepts Control**
 - COE Reductions through Active Control of Rotor Aerodynamics and Geometry
- **Global Energy Concepts O&M**
 - Development of an Operations and Maintenance Cost Model to Identify Cost of Energy Savings for Low Wind Speed Turbines



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Phase II Concept Studies (Offshore, Initiated)



- **AWS Truewind**
 - Development of Atmospheric Profiling and Modeling Techniques to Evaluate the Design and Operating Environment of Offshore Wind Turbines in the Mid-Atlantic and Lower Great Lakes
- **Massachusetts Institute of Technology**
 - Offshore Floating Wind Turbine Concepts: Fully Coupled Dynamic Response Simulations
- **Concept Marine**
 - Semi-Submersible Platform and Anchor Foundation Systems for Wind Turbine Support





Phase II Components (Blades, Pending)



- **TPI**
 - COE Reductions through Active Control of Rotor Aerodynamics and Geometry
- **Knight & Carver**
 - Sweep-Twist Adaptive Blade Design and Fabrication with Laboratory and Atmospheric Test Verification
- **General Electric**
 - Advanced Ultra-Long Blade (AUB)





Phase II Components (Landbased, Pending)



- **Genesis, LLP**
 - Convoloid Gearing for Wind Turbine Applications
- **Clipper**
 - Development of the Clipper VAR Control System
- **Valmont**
 - Development of a Self-Erecting Tower System
- **Tennessee Valley Infrastructure Group**
 - Nacelle Erection System for Tall Towers





Phase II Prototypes (Pending)



- **NPS Direct Drive HAWT**
 - Development of a 2MW Direct Drive Wind Turbine For Low Wind Speed Sites
- **General Electric**
 - Multi-Megawatt Offshore System Development





Summary



- **Public/private partnerships**
- **Diverse program portfolio**
- **Viability and progress**
- **3 ¢/kW·hr in Class 4 by 2012**

